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GB 1485351
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GB 1398246
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GB 1182514
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GB 532304
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(54) **Energy-absorbing assembly**

(57) An energy-absorbing assembly 10 employed particularly as a vehicle bumper includes a compressible energy-absorbing material 22 (such as foamed polyurethane) supported on a beam 12. A sheet of flexible, material 24 is attached to the beam at spaced positions 26 and envelops the energy-absorbing material 22 (when viewed in cross-section) so that a portion of the sheet upon impact can be placed in tension between the impact position 30 and at least one of the spaced positions of attachment 26 to compress and dissipate energy throughout the energy-absorbing material 22. The compressible energy-absorbing material may comprise two blocks 22 spaced on the beam 12 and eveloped by flexible sheets 24 attached to the top and bottom of the beam 12. The sheet 24 may alternatively be attached to the ends of the beam 12.

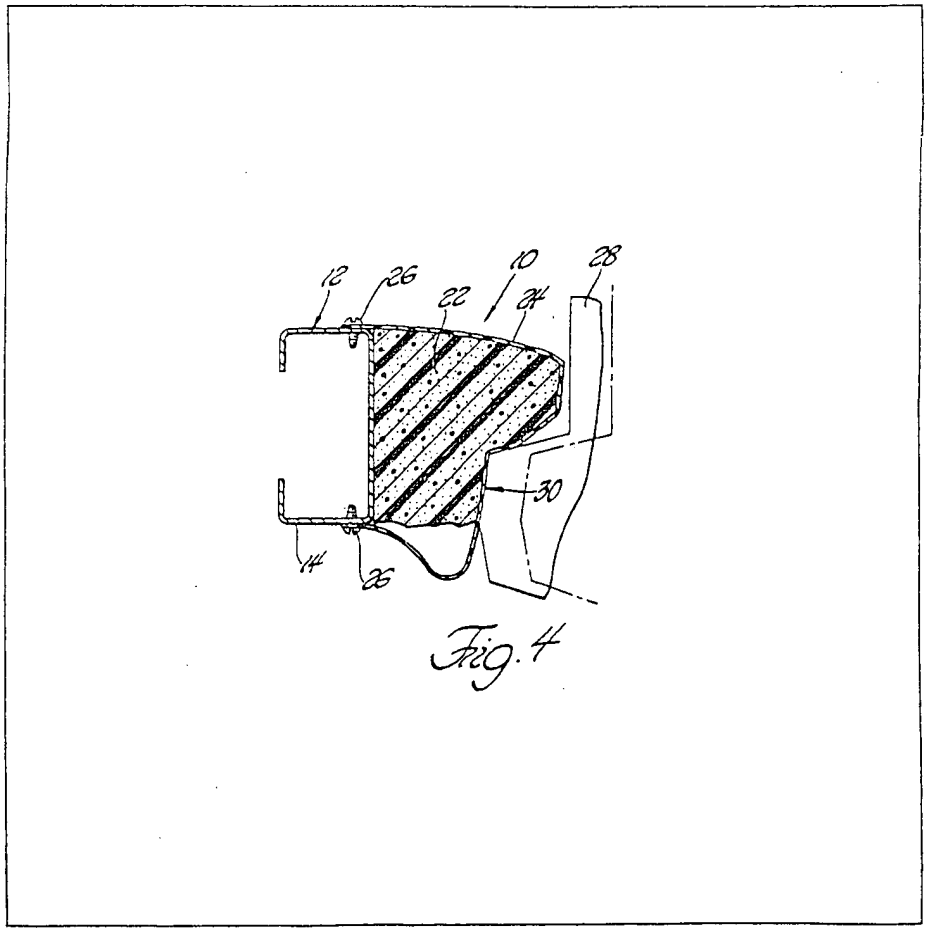

Fig. 4

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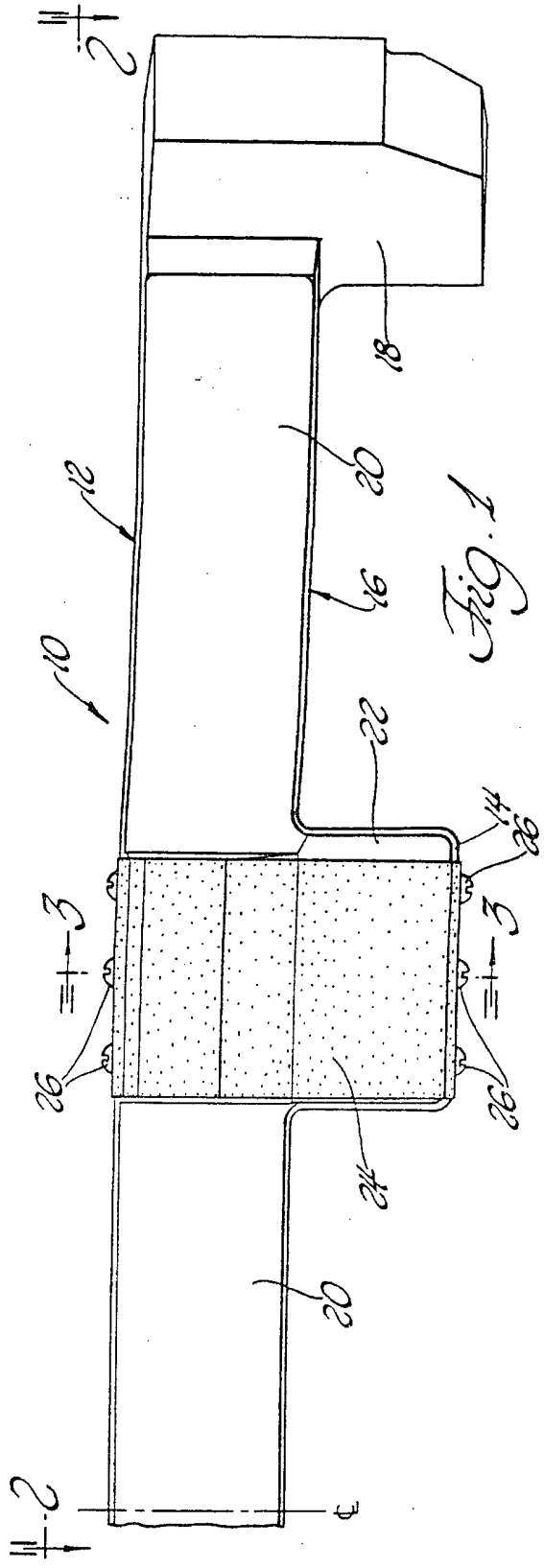

Fig. 1

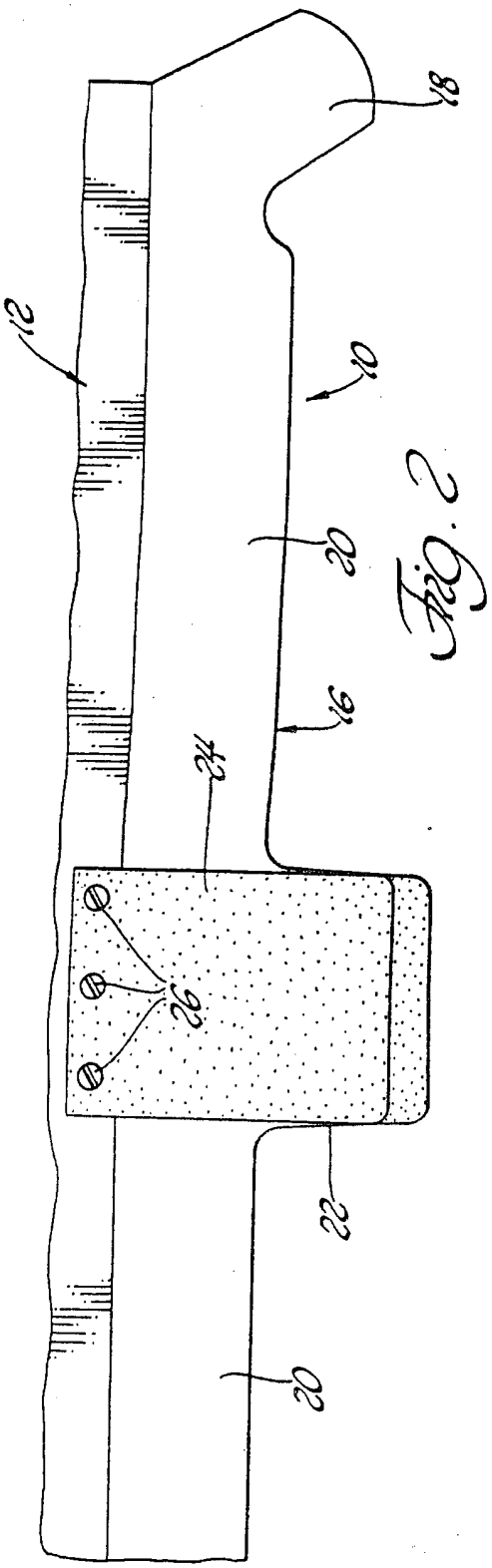

Fig. 2

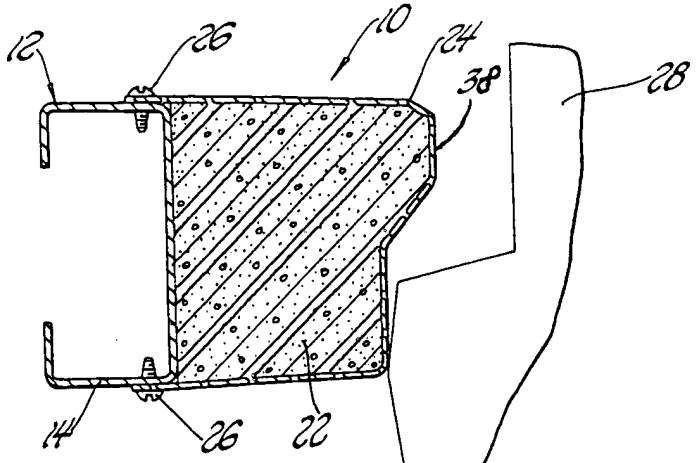

Fig. 3

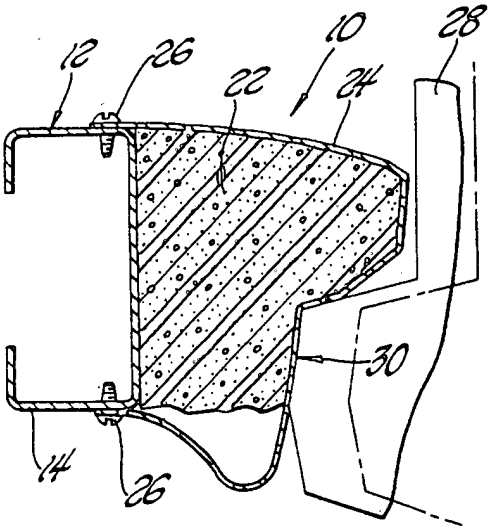

Fig. 4

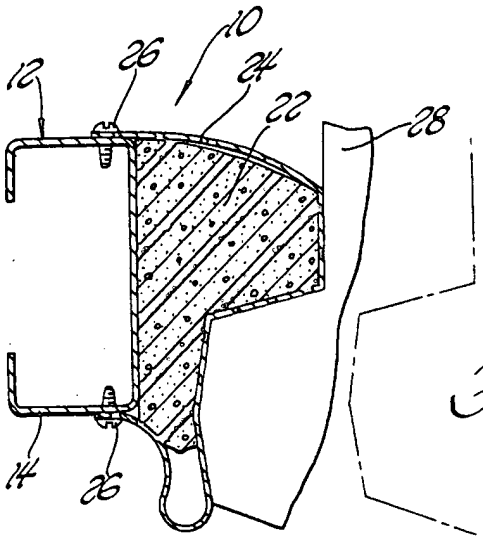

Fig. 5

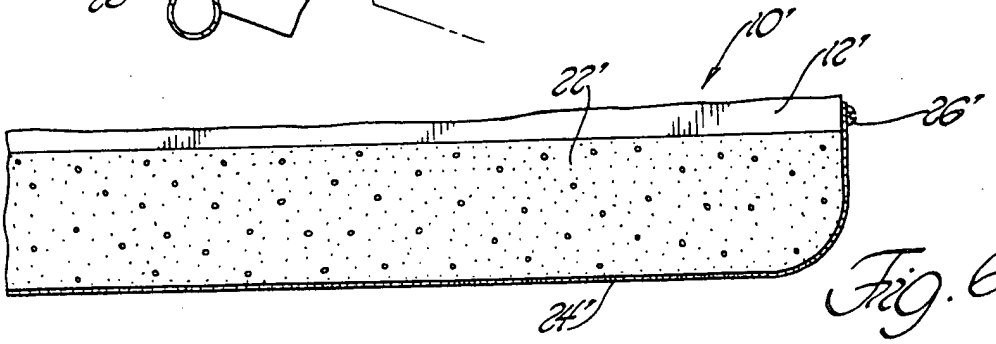

Fig. 6

SPECIFICATION

Energy-absorbing assembly

Technical field

This invention relates to an energy-absorbing assembly of a type employed particularly, but not exclusively, as a bumper on vehicles such as automobiles, for absorbing energy during an impact, as for example during a collision with another vehicle.

Background art

In energy-absorbing assemblies of this type (hereinafter referred to as "the kind specified") it has been proposed to provide, on the vehicle, a rigid beam which supports a compressible energy-absorbing material. This material may be an elastomeric foam such as a polyurethane, and by varying the shape and composition of the foam, assemblies of different energy-absorbing capacities can be made. Thus, U. S. Specification No. 3,787,083 proposes that energy-absorbing material in the form of foamed plastics blocks, be positioned between a rigid beam or sheet and the vehicle to help prevent damage to the vehicle during impact. Alternatively, it has been proposed to use a resilient material to absorb energy, and U.S. Specification No. 1,985,113 discloses a bumper assembly including rubber material which is supported on a rigid beam or bumper of a vehicle and is internally reinforced with one or more sheets of fabric material. It is believed to be a disadvantage of the aforementioned prior proposals that the energy of impact is absorbed by the bumper assembly substantially wholly in the vicinity of the impact, and it is an object of the present invention to provide an impact energy-absorbing assembly in which absorption of energy from the impact occurs at positions remote from the impact, thereby dissipating the energy over a greater volume of the energy-absorbing material.

Statement of invention and advantages

According to the present invention there is provided an energy-absorbing assembly of the kind specified comprising rigid backing means, compressible energy-absorbing means on the backing means for compressing against the backing means to absorb energy in response to an impact, and sheet means of flexible material attached to the backing means at spaced positions in a substantially non-stretchable condition such that, when viewed in a cross-section including two spaced attachment positions, the energy-absorbing means is enveloped within the sheet means and against the backing means whereby, substantially upon impact, the sheet means is placed in tension between the impact position and at least one of the spaced attachment positions to compress the energy-absorbing means within the thus tensioned sheet means portion or portions to dissipate energy throughout the energy-absorbing material compressed within said tensioned sheet means portion or portions.

The sheet means will first be hit during impact at at least one initial impact position and it will be appreciated that during the impact the impact position may change thereby altering the extent or distribution of the tensioned sheet means portion or portions. The tension in the sheet means will be at least partly dependent upon the compressibility of the energy-absorbing means. During an impact it is envisaged that the sheet means may be such that one portion of it is in tension while the remainder is in a relaxed condition.

The positions of attachment of the sheet means to the backing means are preferably fixed and may be at opposite extremities of the sheet means so that said opposite extremities are prevented from moving relative to the backing means.

Preferably the sheet means is positioned at or adjacent the outer periphery of the energy-absorbing means. Thus, the sheet means may, if desired, be slightly embedded within the energy-absorbing means which may be in the form of a foam material, such as an elastomeric polyurethane.

The rigid backing means may be of elongate form with longitudinally spaced blocks of energy-absorbing material projecting forwardly from the backing means. Each block may be covered by a separate sheet and have attachment positions transversely spaced relative to the backing means. Alternatively, the sheet means may be attached at longitudinally spaced positions on the elongate backing means, conveniently at the longitudinal ends thereof, to envelop the energy-absorbing material.

Figures in the drawings

Two embodiments of assemblies in accordance with the invention will now be described by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a front elevational view of part of a first embodiment of the assembly;

Figure 2 is a plan view taken substantially along line 2-2 of Figure 1;

Figure 3 is a cross-sectional view taken substantially along line 3-3 of Figure 1 and showing an impact device at the point of initial impact;

Figure 4 is a view similar to Figure 3 but showing the impact device moved from the point of initial impact (shown in chain-dotted lines) to an intermediate position;

Figure 5 is a view similar to Figure 4 but showing the impact device at a full position of impact, and

Figure 6 is a plan view of part of a second embodiment of the assembly.

Detailed description of the drawings

A first embodiment of an energy-absorbing assembly constructed in accordance with the invention is indicated generally at 10 in Figures 1 to 5, and a second embodiment is indicated generally at 10' in Figure 6.

The energy-absorbing assembly 10 illustrated in Figures 1 to 5 includes a rigid backing means comprising a metal beam 12. As illustrated in Figure 1, the metal beam 12 has a downwardly extending projection 14.

The assembly 10 also includes compressible energy-absorbing means generally indicated at 16 and

disposed on the beam 12 for compressing against the beam 12 to absorb energy in response to an impact. The compressible energy-absorbing means is an elastomeric material, preferably a foamed plastics material such as microcellular polyurethane foam. The elastomeric material defines an energy-absorbing end portion 18 and intermediate portions 20. Disposed along the intermediate portions 20 is a block of elastomeric material 22 which extends forwardly of the intermediate portions 20. It will be appreciated that in Figures 1 and 2 only one-half of the bumper assembly is illustrated with the other half being symmetrical about the centre line so that there are two spaced blocks 22 of elastomeric material.

The assembly 10 also includes a sheet 24 of flexible and non-stretchable material attached to the beam 12 at spaced positions 26, for enveloping the energy-absorbing material of the block 22 within the sheet 24 and against the beam 12 as viewed in the cross-sections of Figures 3 to 5. Upon impact, the sheet 24 can be placed in tension between the impact position and at least one of the spaced positions 26 of attachment to compress the energy-absorbing material or block 22 within the tensioned sheet 24 and thereby dissipate energy throughout the energy-absorbing material of the block 22 compressed within the tensioned sheet 24. In other words, the sheet 24 is attached by bolts or screws 26 along opposite extremities or edges of the sheet to the top and bottom of the beam 12 in a fixed manner so that the extremities or edges of the sheet 24 which are bolted to the top and bottom of the beam are prevented from moving relative to the beam at the positions of attachment. Thus, as illustrated in Figures 3 to 5, as in impact member 28 impacts the sheet 24, the sheet 24 is placed in tension in the upper part thereof between the impact position generally indicated at 30 in Figure 4 and the position of attachment of the sheet to the top of the beam 12 by the screws 26, so as to compress the energy-absorbing material 22 in the upper portion thereof to dissipate energy through the energy-absorbing material compressed within the tensioned sheet 24. The sheet 24 is sufficiently exposed to the impact by a member 28 that negligible energy is absorbed by the block 22 until the impact reaches the sheet 24. As illustrated, the sheet 24 is disposed exteriorly of the energy-absorbing material so that the impact will first engage the sheet. However, the sheet may be slightly embedded within the block 22, although not sufficiently that any appreciable energy absorption would take place by the energy-absorbing foam material disposed exteriorly of the sheet. It is important that the impact engage the sheet immediately so that the sheet is gripped at the point of impact to be placed in tension about the foam material encapsulated within the sheet.

The beam 12 comprising the backing means is elongated and the sheet 24 extends transversely of the beam so as to be attached to the top and bottom of the beam respectively. Since there are two blocks of material 22, one spaced on either side of the centre line of the bumper assembly, there are also two she ts or an individal sheet extending transversely of the beam 12 and associated with each of the blocks 22. Further, the blocks 22 have a front face with an upper portion 38 protruding forwardly of the lower portion, as is best illustrated in Figure 3.

The sheet 24 may be made from metal or various reinforced plastics or other materials which ar flexible yet non-stretchable.

The embodiment of Figure 6 differs from the embodiment of Figures 1 to 5 in that, in the assembly 10' of Figure 6, the sheet 24' is attached by screws 26' adjacent the ends of the beam 12' and extends longitudinally of the beam 12'. The sheet 24' extends over an elastomeric energy-absorbing material 22'. Thus, when the sheet 24' is impacted it will be placed in tension to compress the energy-absorbing material 22' between the point of impact and at least one of the attachments of the opposite extremities of the sheet 24' adjacent the ends of the beam 12'.

In either embodiment the sheet may have inherent resilience and be returned at least partly by this resilience to its pre-impact position after the impact force has been removed. Some energy of the impact may be used up in deforming the sheet. If the sheet is not resilient it may be returned to its pre-impact position by any expansion of the compressed energy-absorbing means after the impact force is removed.

Obviously, many modifications and variations of the present invention are possible and it is therefore to be understood that, within the scope of the appended claims, the invention may be practised otherwise than as specifically described.

CLAIMS

1. An energy-absorbing assembly of the kind specified comprising rigid backing means, compressible energy-absorbing means on the backing means for compressing against the backing means to absorb energy in response to an impact, and sheet means of flexible material attached to the backing means at spaced positions in a substantially non-stretchable condition such that, when viewed in a cross-section including two spaced attachment positions, the energy-absorbing means is enveloped within the sheet means and against the backing means whereby, substantially upon impact, the sheet means is placed in tension between the impact position and at least one of the spaced attachment positions to compress the energy-absorbing means within the thus tensioned sheet means portion or portions to dissipate energy throughout the energy-absorbing material compressed within said tensioned sheet means portion or portions.

2. An assembly as claimed in claim 1 wherein the sheet means is attached to the backing means in a fixed manner so that the spaced positions of attachment of the sheet means are prevented from moving relative to the backing means.

3. An assembly as claimed in claim 2 in which the sheet means is attached at opposite extremities to the backing means so that the opposite extremities are prevented from moving relative to the backing means.

4. An assembly as claimed in any one of the

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preceding claims wherein the sh et means is at or adjacent the outer periphery of the energy-absorbing means so that, on impact, negligible energy is absorbed until the impact reaches the sheet means.

5. An assembly as claimed in any one of the preceding claims wherein the backing means is elongated and the attachment positions of the sheet means are transversely spaced relative to the backing means.

6. An assembly as claimed in any one of the preceding claims wherein the energy-absorbing means comprises at least two spaced blocks on the backing means.

7. An assembly as claimed in claim 6 wherein the sheet means includes one or more sheets associated with each of said blocks.

8. An assembly as claimed in claim 7 when claim 6 is dependent from claim 5 wherein the backing means comprises a beam and each sheet is attached to the top and bottom of the beam to extend over the respective blocks.

9. An assembly as claimed in any one of the preceding claims wherein the energy-absorbing means has a front face with an upper portion protruding forwardly of a lower portion.

10. An assembly as claimed in any one of claims 1 to 4 wherein the backing means is elongated and the sheet means has a principal dimension extending longitudinally of the backing means.

11. An assembly as claimed in claim 10 wherein the backing means comprises a beam and the spaced attachment positions of the sheet means are adjacent the ends of the beam.

12. An assembly as claimed in any one of the preceding claims wherein the sheet means comprises at least one sheet made of metal.

13. An assembly as claimed in any one of the preceding claims wherein the energy-absorbing means comprises an elastomeric foam material.

14. An energy-absorbing assembly of the kind specified substantially as herein described with reference to Figures 1 to 5 of the accompanying drawings.

15. An energy-absorbing assembly of the kind specified substantially as herein described with reference to Figure 6 of the accompanying drawings.

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